

Materials and Coatings

Fire-resistant, Lightweight Electrical Insulation Material

Polyimide composite insulated conductor for medium
to high voltage applications

NASA's Langley Research Center has developed a new class of polyimide composite electrical insulation materials for wires, cable, and bus pipe. These new insulation materials have been shown to withstand a 12-hour gas flame test while maintaining structural and electrical circuit integrities. These extreme fire-resistant insulation systems show promise for use in high voltage, high power systems. They can improve survivability and continuity of the electrical power supply. Besides fire resistance, these materials also provide weight and space savings because of their lightweight nature and exceptionally high performance capability. NASA developed the wire insulation for exploration and space operations. The technology also has applicability to other high voltage, high power systems for the maritime, high-rise building construction, and other industries.

BENEFITS

- Safety and reliability: reductions in fire hazards as the insulation is rated for use at 2,300 degrees F
- Weight reductions: lighter weight than similarly performing insulations
- Space reductions for wiring installations that are constrained by space limits
- Improved properties compared to current insulation materials:
 - low dielectric constant (2.9 at 10 GHz), low dissipation factor, and permittivity
 - excellent moisture and chemical resistance
- Halogen-free

technology solution



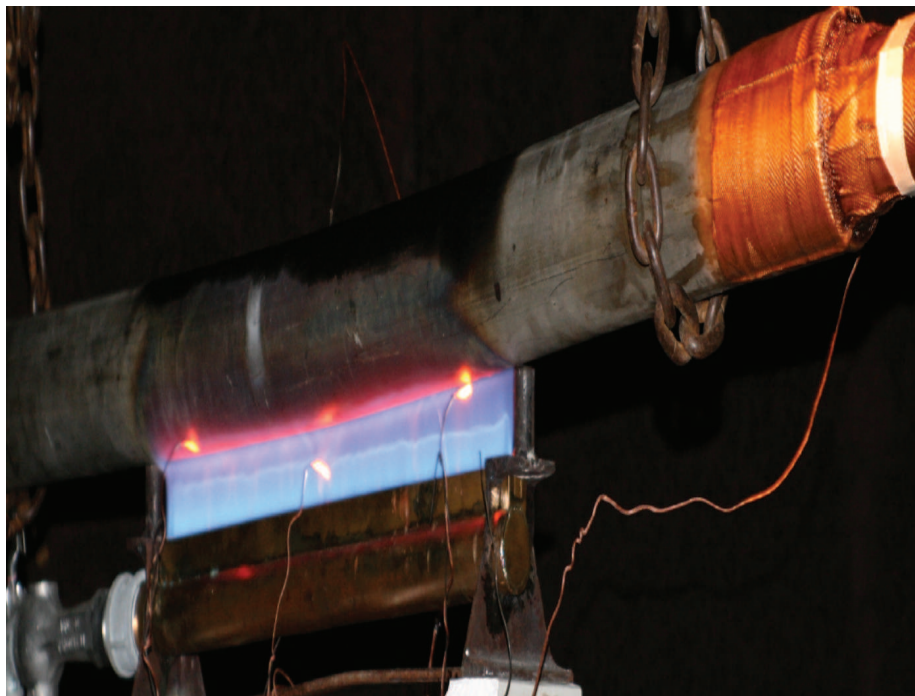
NASA Technology Transfer Program

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THE TECHNOLOGY

The technology combines the superb heat resistance and dielectric properties of the RP46 polyimide, reinforced with glass or quartz fibers or fabric. RP46, developed at NASA, exhibits high mechanical strength and structural durability at elevated temperatures. It also features significantly less moisture absorption and is therefore less susceptible to moisture-induced damage. RP46 demonstrates excellent thermal oxidative stability and chemical corrosion resistance. The advantage of using glass or quartz fiber reinforcement is their ability to maintain physical integrity over a wide range of temperature, humidity, voltage, and frequency.

A copper or aluminum bus pipe insulated with the new insulation material withstood several rounds of 3-hour gas flame tests, each time being exposed to temperatures between 2,100 degrees F and 2,300 degrees F. No fire or fuse failure was observed. Results show that the insulated bus pipe has the ability to maintain both structural and electrical circuit integrity in extreme and corrosive environments.



RP46 composite copper bus pipe withstood 12-hr gas flame test at 2,100,2,300F.

APPLICATIONS

The technology has several potential applications:

- ➡ Aerospace - space operations and exploration
- ➡ Marine - all-electric ships that require large amounts of power to be moved about the ship
- ➡ Construction - enables higher voltage power lines needed for high-rise buildings

PUBLICATIONS

Patent No: 8,545,986

National Aeronautics and Space Administration

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